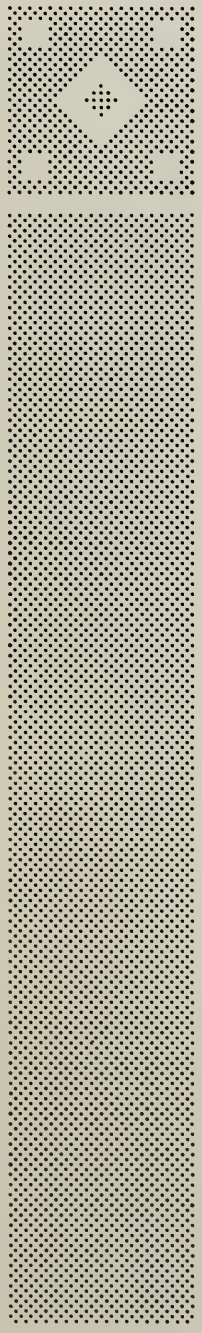
WATERSHED WORK PLAN
for
WATERSHED PROTECTION
and
FLOOD PREVENTION



PIERCE CREEK NO. 2 WATERSHED
Page and Montgomery Counties, Iowa

USDA-SCS-LINCOLN, NEBR. 1973

ADDENDUM

PIERCE CREEK NO. 2 WATERSHED, IOWA

This is a three-section addendum for the purposes of:

Section I - To show the project costs, benefits, and benefit-cost ratio at 5-7/8 percent interest rate (page A.2).

Section II - To present an abbreviated environmental quality plan consistent with the intent of the Water Resources Council's Principles and Standards in accordance with part C.2 of the draft WRC "Schedule and Application of Principles and Standards to Implementation Studies in Process" dated November 21, 1973 (pages A.3-A.6).

Section III - To present abbreviated displays of the selected plan consistent with the intent of the Water Resources Council's Principles and Standards in accordance with part C.3 of the draft WRC "Schedule and Application of Principles and Standards to Implementation Studies in Process" dated November 21, 1973 (pages A.7-A.13).

SECTION I

of

ADDENDUM

for

PIERCE CREEK NO. 2 WATERSHED, IOWA

This section shows the project costs, benefits, and benefit-cost ratio based on 5 7/8 percent interest rate.

1.	Annual project costs are	$18,130
2.	Annual project benefits are	$22,630
3.	The project benefit-cost ratio is	1.2 to 1.0

March 1975

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

Pierce Creek No. 2 Watershed
Page and Montgomery Counties, Iowa

ENVIRONMENTAL PROBLEMS

Land Quality

Gully erosion is widespread in the watershed. Erosion from approximately 300 acres of gullies produces 27,700 tons of sediment per year. Approximately 9.9 acres of land on 26 gullies will be voided annually. This destroys vegetation, is unsightly, and is a safety hazard.

Sediment reduces water quality by increasing turbidity and pesticide content of water. The two primary sediment sources are cropland and gullies. Pesticides and fertilizer are attached to sediment from cropland. The estimated annual sediment production from all upland is 42,300 tons.

Biological Resources

The Iowa Recreation Plan shows that non-consumptive wildlife use, such as bird watching, will double between 1966 and 1980 in this portion of the state.[1/] The large fields of cultivated crops, primarily corn or soybeans, result in a similarity of habitat that restricts wildlife to those adaptable species. This results in high populations of a few species such as rabbit and coyote.[2/] There is presently enough habitat diversity to maintain populations of other wildlife species at a lower level. The established trend toward larger farms with more clean tilled crops will continue to reduce this diversity.

Although not managed for a quality fishery, 8 existing artificial impoundments averaging 1 acre in size experience heavy fishing pressure. Warm water fishing is expected to increase 13 percent between 1966 and 1980 according to the Iowa Recreation Plan.

COMPONENT NEEDS

Gully Stabilization

There is a need to control gully erosion to improve the visual quality of the landscape, reduce land destruction and sediment production, and protect vegetation to make the area more esthetically pleasing.

Vegetative Diversity

There is a need to diversify the types of vegetation for wildlife and to add contrast to the landscape.

1/ Outdoor Recreation in Iowa, Iowa Conservation Commission, 1972
2/ Iowa Conservation Commission - Wildlife Population Densities, 1970.

More Fishing Waters

The expected increase in fishing demand indicates a need for more fishing waters with an associated increase in the proper management of all fishing waters.

PLAN ELEMENTS

1. Provide 100% gully stabilization by installing 26 grade stabilization dams and associated vegetative and protective measures. Livestock will be excluded from a 50-foot area around pools and dams. Detention dams will be utilized where possible to provide aquatic habitat. All gullies can be stabilized at an estimated cost of $914,000.

2. Provide for interspersion of habitat types in the watershed by utilizing a corn, corn, soybean, oat, meadow rotation on all cropland, establishment of trees along watercourses and selected areas in the uplands. Cost of crop rotation through reduced income is $116,800 while establishment of approximately 181 acres of trees will cost $36,200.

3. Stocking all impoundments with largemouth bass, bluegill and channel catfish. All impoundments will be managed for a quality sport fishery. Cost of establishing these fisheries is estimated to be $2,725.

INSTITUTIONAL ARRANGEMENTS

1. Plan element #1.

   Implemented by land user cooperation with the local Soil Conservation Districts who will provide technical assistance. The following governmental agencies may provide funds:

   a. Soil Conservation Service, P.L. 566 Small Watersheds Program.

   b. Agriculture Stabilization and Conservation Service, conservation cost-sharing programs.

   c. Iowa Department of Soil Conservation, conservation cost-sharing programs.

2. Plan element #2

   Implemented by land user cooperation with the local Soil Conservation districts. The local Soil Conservation Districts will provide technical assistance for crop rotation. The reduced income from crop rotation will be absorbed by the land user unless cost-sharing program for this purpose is established. Funds for establishment

of trees will be provided by the same governmental agencies as in element #1. Iowa Conservation Commission Forestry Section, in cooperation with the Forest Service, will provide additional technical assistance for tree establishment.

3. Plan element #3

Implemented by land user cooperation with the Iowa Conservation Commission. The Iowa Conservation Commission will provide technical assistance and fish.

EFFECTS

Installation of 26 grade stabilization dams will:

a. Reduce land destruction and sediment production by controlling gully growth.

b. Improve the visual quality of the landscape by replacing raw gully banks with vegetation or water.

c. Prevent further destruction of vegetation along gully banks.

d. Store approximately 97% of the sediment reaching the grade stabilization structures, thereby improving water quality downstream.

e. Change 116 acres of wildlife habitat from terrestrial to aquatic.

f. Provide water storage at 25 locations for a total of 116 acres.

Exclusion of livestock from pools and dams will:

a. Protect and enhance wildlife habitat by allowing diversification of plant species and increasing total amount of vegetation available for cover.

b. Protect the water quality of pools by reducing turbidity and direct contribution of animal wastes, thereby improving fish habitat and fishing.

c. Protect shorelines from damage by livestock.

Planned crop rotation will:

a. Provide a wider variety of vegetation. The edges where the different types meet with create habitat niches for larger populations and more species of wildlife.

b. Improve the visual quality of the landscape by providing contrasting types of vegetation. This contrast in the form of coloration, height, blooms and fruits, makes the area more esthetically pleasing.

c. Improve the quality of runoff water by reducing turbidity and sediment with the attached pesticides and nutrients. Reduction of chemicals entering the food chain will reduce their concentration in predacious animals.

Establishment of trees along watercourses and selected areas in the uplands will:

a. Provide additional woodland habitat and travel lanes for deer, rabbit, squirrel, pheasant and quail.

b. Add interest and variety to the landscape by contrasting with the shorter agricultural crops.

SECTION III of ADDENDUM

SELECTED PLAN

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects Average Annual
Beneficial effects:	
A. The value to users of increased outputs of goods and services	
1. Flood prevention	$22,540
Total beneficial effects	$22,540

Components	Measure of effects Average Annual
Adverse effects:	
A. The value of resources required for the plan	
1. Grade stabilization structures	
Project installation (structural measures)	$14,540
Project administration	1,780
Operation & maintenance	1,210
Total adverse effects	$17,530
Net beneficial effects	$ 4,990

Date: June 1974

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects
Beneficial and adverse effects:	
A. Areas of natural beauty	1. Project output will make available regional funds and resources that can be used to enhance the physical appearance of 30 farms on 1,110 acres.
	2. Disruption in tranquility of rural environment for an estimated 200 days to four farmsteads when the project measures are being installed.
	3. Create 48.8 surface acres of water.
	4. Inundate 1.5 acres of forest land at Structure L-2.

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects
B. Quality considerations of water, land, and air resources.	1. Reduce erosion on 5,480 acres of agricultural land.
	2. Prevent loss through voiding of 5.4 acres of land and depreciation of 7.4 acres by gully erosion annually in the area of the watershed.
	3. Provide additional water for fire protection and livestock.

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects
C. Biological resources and selected ecosystems.	1. Provide 48.8 acres of aquatic habitat and resting area in reservoir pools for migratory waterfowl.
	2. Modify the ecological community in 4 miles of ephemeral channel.
D. Irreversible or irretrievable commitments.	1. Convert 11 acres of cropland, 32 acres of pasture, and 6 acres of forest land to reservoir pools.

Date: June 1974

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects (Average Annual) State of Iowa	Rest of Nation
Income:		
Beneficial effects		
A. The value of increased output of goods and services to uses residing in the region		
1. Flood prevention	$22,540	
2. Secondary benefits	90	
Total beneficial effects	$22,630	

Components	Measure of effects (Average Annual) State of Iowa	Rest of Nation
Income:		
Adverse effects:		
A. The value of resource contributed from within the region to achieve the outputs		
1. Grade Stab. Strs.		
Project Construc.	$ 1,190	$13,350
Project Admin.	110	1,670
Oper. & Maint.	1,210	-
Total adverse effects	$ 2,510	$15,020
Net beneficial effects	$20,120	-$15,020

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects: State of Iowa	Measure of effects: Rest of Nation
Employment:		
Beneficial effects:		
A. Increase in the number and types of jobs		
1. Employment for project construction	10 semi-skilled jobs for 78 days	
2. Employment for operation and maintenance	0.1 permanent semi-skilled job	
Total beneficial effects	10 semi-skilled job for 78 days 0.1 permanent semi-skilled job	

Components	Measure of effects: State of Iowa	Measure of effects: Rest of Nation
Employment		
Adverse effects: None		
Net beneficial effects	10 semi-skilled jobs for 78 days 0.1 permanent semi-skilled job	

Date: June 1974

SELECTED PLAN

SOCIAL WELL-BEING ACCOUNT
Pierce Creek No. 2 Watershed, Iowa

Components	Measure of effects
Beneficial and adverse effects	
A. Real Income Distribution	1. Create 0.1 of low to medium income permanent job for local resident.
	2. Create regional income benefit distribution of $22,630. Income distribution is: Under $3,000 — 13% $3,000 to $10,000 — 54% Over $10,000 — 33% It is assumed that benefits will be distributed at about the same percentages.
B. Life, health and safety	1. Risk of injury or death due to tractor accidents at gully banks will be reduced on approximately 7 miles of gully.
C. Educational, cultural and recreational opportunities.	1. Provide aquatic setting for observation of fish and waterfowl.

Date: June 1974

WATERSHED WORK PLAN AGREEMENT

between the

PAGE COUNTY SOIL CONSERVATION DISTRICT
MONTGOMERY SOIL CONSERVATION DISTRICT
PAGE COUNTY BOARD OF SUPERVISORS
MONTGOMERY COUNTY BOARD OF SUPERVISORS
in the State of Iowa
(hereinafter referred to as the Sponsoring Local Organizations)

and the

SOIL CONSERVATION SERVICE
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Pierce Creek No. 2 Watershed, State of Iowa, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress, 68 Stat. 666) as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for Pierce Creek No. 2 Watershed, State of Iowa, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about four years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions and stipulations provided for in the watershed work Plan:

1. The Sponsoring Local Organizations will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated cost $19,850).

2. The Sponsoring Local Organizations assure that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organizations and the Service as follows:

	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Relocation Payment Costs (Dollars)
Relocation Payments	16.6	83.4	0 1/

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Sponsoring Local Organizations will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
All structural measures	0	100	$185,060

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Engineering Cost (Dollars)
All structural measures	0	100	$36,970

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be $1,850 and $27,730 respectively.

7. The Sponsoring Local Organizations will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

8. The Sponsoring Local Organizations will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

PAGE COUNTY SOIL CONSERVATION DISTRICT
Local Organization

By /s/ George K. Annan

Title Chairman

Address Shenandoah, Iowa 51601
Zip Code

Date 4-15-75

The signing of this agreement was authorized by a resolution of the governing body of the Page County Soil Conservation District adopted at a meeting held on April 15 19 75 .

/s/ Marjorie Wright
(Secretary, Local Organization)

Address 1215 5th Ave., Shenandoah
Zip Code 51601

Date April 15, 1975

MONTGOMERY SOIL CONSERVATION DISTRICT
Local Organization

By /s/ Dick Smith

Title Chairman

Address 1411 - 2nd, Red Oak, Ia. 51566
Zip Code

Date April 23, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Montgomery Soil Conservation District adopted at a meeting held on April 23 19 75.

/s/ Margaret Barnes
(Secretary, Local Organization)

Address 1411, 2nd, Red Oak, Ia. 51566
Zip Code

Date April 23, 1975

PAGE COUNTY BOARD OF SUPERVISORS
Local Organization

By /s/ Alfred Sump

Title Chairman

Address Rte 1, Box 175, Clarinda, Iowa 51632
Zip Code

Date April 29, 1975

The signing of this agreement was authorized by a resolution of the Page County Board of Supervisors, governing body of Page County adopted at a meeting held on April 29 19 75.

/s/ Betty Stickelman
County Auditor

Address Clarinda, Iowa 51632
Zip Code

Date April 29, 1975

MONTGOMERY COUNTY BOARD OF SUPERVISORS
Local Organization

By /s/ Dale F. Lindner

Title Chrm. Bd. Supervisors

Address Courthouse Red Oak 51566
Zip Code

Date April 22, 75

The signing of this agreement was authorized by a resolution of the Montgomery County Board of Supervisors, governing body of Montgomery County, adopted at a meeting held on April 22 19 75.

/s/ Kurt L. Johnson
County Auditor

Address Red Oak, Iowa 51566
Zip Code

Date April 22, 1975

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

/s/ Wilson T. Moon
State Conservationist

5-1-75
Date

WATERSHED WORK PLAN

PIERCE CREEK NO. 2 WATERSHED
Page and Montgomery Counties, Iowa

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666) as amended.

Prepared by: Page County Soil Conservation District
Montgomery Soil Conservation District
Page County Board of Supervisors
Montgomery County Board of Supervisors

With Assistance by

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service

March 1975

TABLE OF CONTENTS

WATERSHED WORK PLAN

PIERCE CREEK NO. 2 WATERSHED
Page and Montgomery Counties, Iowa

June 1974

SUMMARY OF PLAN

The Work Plan for Pierce Creek No. 2 Watershed, Page and Montgomery Counties, Iowa was prepared by the Page and Montgomery Soil Conservation Districts, and by the Page and Montgomery County Boards of Supervisors as joint local sponsoring agencies. Technical assistance was provided by the United States Department of Agriculture, Soil Conservation Service. The U.S. Forest Service, cooperating with the Iowa Conservation Commission, Forestry Section, developed the forest land treatment phase of the plan.

The Pierce Creek No. 2 Watershed is located in Page and Montgomery Counties near the town of Essex in southwestern Iowa. It consists of several laterals that drain directly into the East Nishnabotna River. The watershed contains 8,360 acres. There are 7,630 acres in Page County and 730 acres in Montgomery County. It is approximately 7 miles long and 3 miles wide at its widest point. No towns are located in the watershed.

The major watershed problems are damages to upland areas from gully erosion, floodwater damages to bottom land and an accumulation of sediment deposits in outlet floodways that cross the Nishnabotna River flood plain.

Croplands in the upland drainageways are being destroyed by gully erosion and adjacent lands are being damaged.

Approximately 40 acres of highly productive bottomland cropland is being damaged each year by floodwater.

Sediment deposits reduce the capacity of outlet floodways and cause inadequate disposal of floodwater as it flows out of the upland across the bottom land into the East Nishnabotna River.

Damages also occur to roads, bridges, fences and farm crossings.

The estimated average annual damages of $23,910 are shown on table 5.

The project for watershed protection and flood prevention will be installed during a 4-year installation period at a total cost of $299,450 (table 1). The P.L. 566 share is $249,760 and the other or local share is $49,690.

Land treatment measures for erosion control will be installed on the lands where sheet erosion is a problem. Land treatment measures to be installed are terracing, contouring, grassed waterways, tree planting, woodland improvement and wildlife habitat development. The installation cost of these measures is estimated to be $27,990. These costs will be borne by the landowners, State funds and Federal funds provided under authorities other than P.L. 566. Land treatment measures will be maintained by the landowners and/or operators of the farms on which these measures are installed in accordance with cooperative agreements entered into with the District.

The structural measures consist of nine grade stabilization structures. They will be installed to reduce damages from erosion, floodwater and sediment. Two acres of wildlife mitigation measures will be installed. No relocation payments are included in this project. The estimated installation cost of these measures is $271,460. Of this amount, P.L. 566 will bear $249,760. Other or local funds will provide the remaining amount of $21,700.

The structural measures will be operated and maintained by the District and County using tax revenues available from a county-wide tax on agricultural lands. The estimated average annual maintenance cost of the structural measures is $1,210 (table 4).

Of the 54 farms in the watershed, benefits to land from the reduction of gully erosion damage will occur on 30 farms, 2 farms will benefit from the reduction of floodwater damages and 5 farms will benefit from the reduction of damages from sediment. A reduction of damages will also occur on agricultural and non-agricultural sources.

Water will be stored in the sediment pools of all structures. These pools vary from 2.9 to 15.2 acres in size and may be stocked with fish by the landowner. While the pools will provide limited recreation to land users in the immediate area, the public recreation potential is insignificant. Monetary values of these benefits were not evaluated.

There are 54 farms located entirely or partially within the watershed. Conservation plans have been developed on 27 farms. Local landowners and operators have installed land treatment measures valued at $109,590 (table 1A).

ENVIRONMENTAL SETTING

Physical Resources: Pierce Creek No. 2 Watershed is located in extreme southwestern Iowa in Page and Montgomery Counties. It consists of 7,630 acres in Page County and 730 acres in Montgomery County for a total of 8,360 acres or 13.1 square miles. The watershed is approximately 7 miles long and has a maximum width of 3 miles. The eastern boundary of the watershed is the right bank of the East Nishnabotna River; Pierce Creek No. 2 has no main stream but consists of drainage area of several right bank tributaries of the East Nishnabotna River. The East Nishnabotna River combines with the West Nishnabotna River to form the Nishnabotna River subregion of the Missouri River region as delineated by the Water Resources Council. 1/

There are no cities located in the watershed. The city of Essex, population 770 2/, is located across the river from the watershed. Job opportunities and a marketing center are available in the Omaha-Council Bluffs metropolitan center located 60 miles northwest of the watershed. Shenandoah, population 5,968 2/, 6 miles south; and Red Oak, population 6,210 2/, 16 miles north of the watershed, have experienced an influx of industry which provides job opportunities for area residents.

Resource problems in the watershed are damages to upland areas from gully erosion, floodwater damages to crops, and impaired drainage due to sediment accumulation in outlet drainageways that cross the East Nishnabotna River flood plain. Approximately 40 acres of crops are damaged nearly every year by flood water. It is estimated that 5.4 acres are voided and 7.4 acres are depreciated by gully erosion each year.

The watershed is located in the Marshall soil association area. The soils are derived from the Wisconsin loessial deposits and Kansan glacial till. Loess covers most of the upland area with till outcrops on the lower part of the slopes. These soils, developed under tall grass prairie vegetation, are characterized by high levels of organic material. Marshall soils comprise about 45 percent of the association, Shelby 5 to 15 percent with Minden, Colo, Judson, and Nodaway and other minor soils occupying the rest of the area. Characteristics of and the relative location of these soils are shown on figure 27.

Marshall soils are well drained, rock free silty clay loams occurring on nearly level to steeply sloping uplands. Slopes are typically between 2 to 5 percent and range from 1 to 30 percent. The very dark brown surface layers may be completely removed by erosion. The subsoil is a moderately permeable dark brown silty clay loam. These slightly acid soils,pH 5.8 to 6.5, are extensively used for crop production.

1/ Atlas of River Basins of the United States, United States Department of Agriculture, Soil Conservation Service, Washington, D.C., June 1970.

2/ 1970 Census Data.

The moderately good to somewhat poorly drained Minden soils occurring on the broader level divides have slopes from 0 to 3 percent. They are rock free silty clay loams with a black surface soil and brown and gray subsoil. The subsoil has moderate permeability. Minden soils are medium acid with pH 5.6 to 6.5. They are used for crop production.

The Shelby soils are loams derived from glacial till. They occur on upland side slopes with the typical slopes of 14 to 25 percent and have slopes ranging from 5 to 30 percent. They formed under prairie vegetation, have very dark brown surface soil and yellowish-brown subsoil. The surface has good internal drainage and the subsoil moderately slow permeability. Shelby soils are strongly acid with pH from 5.1 to 6. The flatter slopes are used for crop production and the steeper slopes for pasture.

Judson soils are silty clay loam with good to moderately good drainage. The subsoil has moderate permeability. They are located at the foot of upland slopes on alluvial fans. The parent material of Judson soil is silty colluvium. Slopes range from 1 to 9 percent with typical slopes between 2 to 5 percent. The surface soil is very dark brown with dark brown subsoil. These slightly acid soils, pH 6.1 to 7.0, are generally used for cropland.

The poorly drained Colo soils are silty clay loams formed from alluvium. They are bottomland soils with typical slopes of 0 to 2 percent with a range of 0 to 5 percent. The subsoil is black to very dark gray with moderately slow permeability. The surface soil is black. These soils are slightly acid with pH range of 5.8 to 7.0. They are used for intensive row crop production. These soils are subject to flooding.

Nodaway soils are silty loams occurring on the bottom land. These soils formed from alluvium under forest vegetation. They have slopes of 0 to 2 percent, moderately good drainage, and are neutral with a pH 6.6 to 7. The surface soil is dark grayish brown and a lower soil varying from grayish brown to dark grayish brown. Nodaway soils have moderate permeability. Even though subject to flooding these soils are used for intensive row crop production.

The parent material for most of the soils is the Wisconsin loess. The source of this material was chiefly windblown silt from the Missouri River flood plain. The loess is variable both in color and composition due to the varying conditions under which it was deposited and distance from the source.

The deposit of loess varies widely in thickness due to erosion which has occurred since its deposition. The average depth is estimated to be 20 feet.

Underlying the loess is the Kansan till, a yellowish heterogeneous mixture of clay, silt, fine sand, coarse sand and boulders. It is firm

and compact. Where exposed, its surface is moderately loose; however, a few inches below the surface it is compact and hard; and if wet, it is tough and gummy. The till has been estimated to have an average thickness of 125 feet. Underlying the Kansan till is the Nebraskan drift, a very dense drift, which lies on Pennsylvanian limestone, shale and sandstone. The topography is classed as mature. It is characterized by moderately wide, slightly rounded ridges with strongly sloping sideslopes and well defined alluvial valleys. The flood plain of the valleys which separate the main ridges account for a large part of the level land of the Marshall region.

Elevations reach their maximum in the northwest part of the watershed where they reach 1,190 feet above sea level. The lowest elevation, at the southeast end of the watershed, is 968 feet above sea level.

The climate of the watershed is of the extreme midcontinental type. Average annual precipitation is 33 inches with 24 inches occurring as rain during the months of April through September. Snowfall averages 26 inches annually. 1/ 2/

January, the coldest month, has an average temperature of 24°F and July, the hottest month, an average temperature of 78°F. Average annual temperature is 52°F with recorded extremes of -29° and +112°F. 1/2/

The average frost-free growing season is 162 days from mid-April to early October.

Runoff from periods of short duration excessive rainfall typical of the climate cause flooding and channel stabilization problems. The recorded maximum point rainfall at Omaha for various durations is as follows: 5 minutes, 1.0 inch; 15 minutes, 1.86 inches; 1 hour, 2.62 inches; 6 hours, 4.45 inches; and 24 hours, 7.03 inches.3/ Rainfall intensity in inches per hour is shown in the following table.

1/ Climatic Summary of the United States - Supp. for 1931 through 1952, U.S. Department of Commerce, Weather Bureau.

2/ Climatological Data-Annual Summaries 1953 through 1972- U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

3/ Technical Paper No. 2 - Maximum Recorded U.S. Point Rainfall - U.S. Department of Commerce, Weather Bureau.

Rainfall Intensity - Inches per Hour [1]

Duration	Frequency - Years 2	5	10	25	50	100
5 minute	4.5	6.0	7.0	8.2	9.2	10.0
15 minute	2.9	4.0	4.8	5.6	6.5	7.1
1 hour	1.3	1.7	2.2	2.7	3.0	3.4
6 hours	0.32	0.47	0.58	0.70	0.80	0.89
24 hours	0.12	0.15	0.17	0.22	0.25	0.28

Subeconomic coal resources underlie the area.[3] Some sand and gravel have been produced from alluvium in the river flood plain near the watershed. No other mineral resources of economic importance are known.

The principal supply of ground water is in shallow, unconsolidated alluvial deposits. This aquifer is the principal source of domestic and livestock water. On the East Nishnabotna River flood plain this water is of good quality and adequate supply. In the higher parts of the watershed the supply is inadequate during periods of extended drought.[2]

Land use in the watershed is as follows:

Land Use	Acres	Percent
Cropland	6,271	75
Pasture	1,471	17
Forest land	58	1
Other	560	7
Total	8,360	100

Crops are cultivated for grain production and livestock feeding. Natural plant communities have been destroyed except for woodlands adjacent to streams. These communities will probably remain in the same successional stage because of extensive agricultural activities in the area.

Surface water resources in the watershed are limited to eight ponds constructed by farmers for gully control or livestock water.

The main drainage of the watershed is southeasterly. It consists of several laterals that drain directly into the East Nishnabotna River. Approximately 2 miles of modified channel are in the East Nishnabotna River flood plain, the remainder is natural channel. Flow conditions are classified as ephemeral on all laterals.

Plant and Animal Resources: Small, ephemeral streams provide no fishery because of low water levels, or the lack of water, throughout much of

1/ Technical Paper No. 25, Rainfall Intensity-Duration-Frequency Curves, U.S. Department of Commerce, Weather Bureau.

2/ An Inventory of Water Resources and Water Problems, Nishnabotna River Basin, Iowa, Bulletin #2, Iowa Natural Resources Council - 1955.

3/ Coal Resources of Iowa, Iowa Geological Survey Technical Paper 4, 1965.

the year. Eight privately owned farm ponds in the watershed provide a sport fishery of channel catfish and large mouth bass.

The upland portion of the watershed contains some good upland wildlife habitat. Small scattered tracts of woody cover, composed mainly of elm, oak, maple, and cottonwood trees, are found in conjunction with drainageways. The watershed contains a high density of cottontail rabbit and coyote; moderate density of fox squirrel, pheasant and quail; and a low density of red fox, waterfowl, and whitetail deer.[1/]

Utilization of the fish and wildlife in this watershed by sportsmen is generally limited to local residents. Access is through private property.

Economic Resources: All land within the watershed is privately owned except for transportation rights-of-way.

The major farm enterprise in the watershed is the feeding of livestock. Other types of farming include cash grain such as corn and soybeans with some oats and hay. Crop yields average 120 bushels of corn and 37 bushels of soybeans per acre. Corn acreage has remained about the same in Page County from 1964 to 1969. Total production during this time has increased approximately 50 percent because of increased yields. [2/] The most significant change in the row crop pattern has been the increase of soybean acreage and yields between 1964 and 1969. Soybean acreage has increased 26 percent to 48,181 acres while production has increased 77 percent.[2/] This trend is important since most of the increased soybean acres represent a change to row crop from some non-row crop use such as oats or wheat.

There are 54 farms located entirely or partially within the watershed. Approximately 52 percent of the farms are owner-operated. The average size farm in Page County is 260 acres.

The average value of land in Page County is $320 per acre.[3/] According to information from local people the land included in this watershed would exceed this value at least 50 percent.

Adequate transportation facilities are available to the watershed. County Highway H traverses the center of the watershed in a north-south direction. County Highway M passes through the watershed in an east-west direction. State Highway 48 is located just outside the watershed boundary. The Burlington Northern Incorporated railroad is located adjacent of State Highway 48.

Both counties in the watershed have a decreasing population. Approximately 12 percent of the population was lost from 1960 to 1970.

1/ Iowa Conservation Commission Data, 1970. Based on high, moderate, low and infrequent scale.
2/ 1964 and 1969 Census of Agriculture.
3/ 1969 Census of Agriculture.

The median annual family income is $7,194 in Page County. This compares with the state median of $9,018. 1/

The following information is indicative of trends in agriculture in Pierce Creek No. 2 Watershed. Average value per acre of farmland increased 54 percent from 1964 to 1969. The average size of farm in Page County increased with most of the growth occurring in farms between 500 and 999 acres in size. There was no increase in the number of farms over 1,000 acres.

The number of tenants in Page County decreased by 26 percent from 1964 to 1969. The average age of farm operators dropped 0.3 year, from 51.4 to 51.1 years of age. 2/

About 43 percent of all the farmers in Page County had some off-farm employment. An increase of 22 percent in off-farm employment occurred from 1964 to 1969. 2/

Local employment opportunities were discussed with the Chambers of Commerce of Red Oak and Shenandoah. The Red Oak office reported approximately 400 new jobs have been created in new and expanded industries in the past year. They also reported that an additional 200 jobs will be created when these industries begin operating at full capacity. The office at Shenandoah reported approximately 400 jobs have been created in two new and several expanded industries within the past 5 years. 3/

Unemployment statistics for Shenandoah show an unemployment rate of about 3.7 percent for 1971 and the first 6 months of 1972. This is indicative of job opportunities for the area. 4/

Soil, Water, and Plant Management Status: The trend of land use in Page County from 1964 to 1969 has been to convert other land uses to cropland. Cropland has increased 15 percent, pasture decreased 43 percent, forest land decreased 2 percent and other uses decreased 5 percent. 5/ This trend is expected to continue in the watershed until approximately half of the present pasture is converted to cropland.

Both Page and Montgomery Counties have active soil conservation district programs. Montgomery district was established in 1940 and Page County district in 1941. Both are active in all phases of soil and water conservation.

1/ 1970 Census data.
2/ 1969 Census of Agriculture
3/ Letters from Chambers of Commerce of Red Oak and Shenandoah, Iowa
4/ Unpublished Special Report - Iowa Employment Service.
5/ 1964 and 1969 Census of Agriculture.

Conservation land treatment valued at $109,590 has been applied in the watershed with an additional $27,990 planned as part of the project. Presently, 2,795 acres of cropland, 1,471 acres of grassland, 58 acres of forest land and 274 acres of other land is considered adequately protected.

Of the 54 farms wholly or partially within the watershed, 30 are under district agreement and conservation plans have been developed on 27. Seventy-three percent of the watershed is covered by district agreements and 63 percent is covered by conservation plans.

The State of Iowa, through the Department of Soil Conservation, cost shares with landowners for soil conservation practices.

Recreational Resources: There are no public recreational facilities in the watershed; however, there are 2 state parks within 25 miles. One has picnicking, boating and fishing while the other offers picnicking, nature hikes, and sightseeing.

Archeological and Historical Resources: Soil Conservation Service field studies indicate no places of archeological or historical value within the watershed. No sites are listed in the National Register of Historic Places or Outdoor Recreation in Iowa. Consultation with the State Historic Preservation Officer revealed one site in the county outside the watershed area has been reported. A study of the area indicated that construction of the structures contained in the plan will not cause any loss of Archeological or historical values.[1/]

WATER AND RELATED LAND RESOURCE PROBLEMS

Erosion Damage: The annual estimated sediment production from all upland in the watershed is 42,300 tons; this is equivalent to 6.6 tons per acre per year.

Gross annual sheet and rill erosion rates average: Cropland 3.5 tons per acre, grassland 2.1 tons per acre, and forest land 1 ton per acre. These average erosion rates do not degrade land quality beyond tolerable limits. Approximately 1,432 acres have erosion rates high enough to cause a decline in production by removal of fertile top soil. Sheet and rill erosion provides an annual average of 14,600 tons of sediment to the East Nishnabotna River. Average annual sediment yield from cropland is 2.1 tons per acre and from grassland and forest land 1 ton per acre.

Gully erosion provides an estimated 27,700 tons of sediment per year or 4.3 tons per acre per year from the erodible upland area of the watershed.

Gully erosion contributes to the degradation of productivity of cropland and pasture in several ways. Land destroyed by voiding is lost to production and much of the area adjacent to the gully depreciates to a less intensive use.

1/ Unnamed study report of archeological and historical resources of Pierce Creek No. 2 Watershed by Sylvan T. Runkel, Environmental Consultant.

It is estimated that gully erosion above planned structures will void 270 acres and 370 acres of land will be depreciated to a lesser use during the next 50 years. Income will be lost on 270 acres and reduced on 370 acres. As gullies get deeper and wider the cost of maintaining fences and farm crossings will increase. These fences and farm crossings will eventually be abandoned. Wildlife habitat along the upland drainageways will disappear due to land voiding.

The total estimated damage of $19,290 per year is caused by gully erosion.

Sediment Damage: Sediment deposition in the drainage ditches reduces capacity and causes flooding. It also impairs subsurface drainage of the adjoining land. Cost of sediment cleanout to maintain capacity and depth of the outlet drain below structure site K-1 is $1,500 annually.

Floodwater Damage: Floodwater damage occurs nearly every year to crops on the flood plain below structure site J-2. The floodwater damage consists of complete or partial loss of crops, reduction of yields and delay of tillage operations. If operations are sufficiently delayed, lower value crops are substituted. Two landowners are affected by flood damages.

The flood plain is subject to flooding at any season of the year with 98 percent of the floods occurring during the growing season. Flooding begins at the 1.3 year frequency and all floods cover the entire 40 acre flood plain. It is intensively cropped to corn and soybeans and this use is expected to continue.

The average annual floodwater damage to crops is $920.

Plant and Animal Resource Problems: The monoculture of crop production results in a similarity of habitat that restricts wildlife to those adaptable species. This results in high populations of a few species such as rabbit and coyote. There is enough diversity to maintain populations of other wildlife species at a lower level. Wildlife populations are expected to remain stable or decline unless more diversity of habitat is created.

PROJECTS OF OTHER AGENCIES

No other Federal or State agency has existing or proposed programs for water resource development that will affect the works of improvement included in this project.

PROJECT FORMULATION

An application for project action was submitted by the sponsors and approved by the State Soil Conservation Committee in 1967. The sponsors listed their objectives on this application.

In October of 1969 the sponsors and landowners were notified that the Soil Conservation Service was starting a preliminary investigation to determine land treatment and watershed protection programs. By letter on November 21, 1969, five State agencies and three Federal agencies were notified of this. On November 20, 1969 representatives of the State Conservation Commission, U.S. Fish and Wildlife Service and Soil Conservation Service reviewed the biology of the watershed. Notice was mailed to all landowners and farm operators in the watershed, the sponsors, extension director and Page County Conservation Board inviting them to a public meeting to present the results of the preliminary investigation. Seventeen of the above people attended this meeting on April 27, 1970. A request for public recreation was made. It was dropped when it was found that no suitable recreation site existed. The sponsors unanimously accepted the preliminary investigation report and requested the Service to seek planning authorization.

A tri-agency watershed biology review was held on July 7, 1970 with U. S. Fish and Wildlife, State Conservation Commission and Soil Conservation Service personnel present.

Ten State and 13 Federal agencies were notified by letter on October 15, 1970 that planning assistance was authorized.

The watershed directors held an informational meeting for landowners, Soil Conservation District Commissioners, and County Supervisors. Three SCS employees were present to answer questions. As a result of this November 2, 1970 meeting, written proposals for moving structures proposed in the preliminary investigation and for adding grade stabilization structures were submitted to the SCS. These suggestions were considered during work plan development.

A meeting on November 29, 1971 with the watershed directors, Page County District Commissioners and landowners and farm operators was held. The people attending this meeting were informed of planning progress. They discussed the status of land treatment and made recommendations for additional treatment.

During plan development several meetings were held with the Page County Engineer and Board of Supervisors about locating stabilization structures on roads. The County decided not to participate in road structures.

A public information meeting was held on February 17, 1972 to present the results of economic, engineering, and biological investigations. Those present included 15 landowners, members of 3 of the sponsors, the Page County Engineer, 3 employees of the State Conservation Commission and 7 SCS employees. The need for wildlife habitat mitigation measures was discussed. A resolution was passed unanimously to proceed with preparation of a watershed work plan incorporating as many of the proposed structures as can be justified.

A recommendation was received from the State Conservation Commission on April 4, 1972 for inclusion of 1½ acres of wildlife habitat mitigation. On August 3, 1972 the Bureau of Sport Fisheries and Wildlife concurred in this recommendation. Other recommendations were received from the Bureau at this time.

The Forest Land Plan was received from the Forest Service on July 24, 1972.

Recommendations for vector control measures were received from the Public Health Service, Department of Health, Education and Welfare.

Pierce Creek No. 2 Watershed is not located in an area with a comprehensive river basin plan or resource conservation and development plan completed or under construction.

Objectives: The goals to be achieved through application of land treatment measures during the project installation period are:

1. Adequately protect an additional 920 acres of land from soil losses above tolerable limits.

2. Reduce average annual sheet and rill erosion from 3.5 to 2.7 tons per acre per year on cropland and from 2.1 to 1.0 on pasture.

3. Adequately protect 75 percent or more of lands above structures.

4. Protect land that is being changed from pasture to crop production.

5. Allow more intensive use of cropland.

The flood damage reduction goal is to eliminate all flooding from the 5-year and more frequent floods on the 40 acre flood plain below structure J-2.

The gully erosion reduction goal is to eliminate voiding of 5.4 acres and the depreciation of 7.4 acres annually. Cleanout costs in the

channel below site K-1 were to be reduced 90 percent by trapping sediment.

Reduction of road and bridge maintenance and bridge replacement costs is a goal of the Montgomery and Page County Boards of Supervisors.

Achievement of the flood prevention objectives with minimum damage to wildlife habitat is a goal.

Environmental Considerations: A reconnaissance study and report by the Iowa Conservation Commission recommends a minimum of 1½ acres be developed to mitigate the loss of habitat at structure L-2. Two acres will be available in the vicinity of L-2 and will be fenced and planted to wildlife food and cover plants.

Construction operations will be in compliance with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement. Noise, water and air pollution caused by construction operations will be regulated by the following methods as needed.

1. Leaving the existing vegetation on work areas as long as possible.
2. Constructing debris basins.
3. Diverting runoff water from highly erodible areas.
4. Establishing temporary vegetative cover.
5. Controlling smoke during burning.
6. Suppressing dust on haul roads.
7. Scheduling operations so that unvegetated areas are not exposed over long periods of time.

Alternatives: The alternative to the planned project is no project. Conservation land treatment measures would continue to be installed under the program of the Soil Conservation Districts. Net annual monetary benefits of $5,100 will be foregone if the project is not implemented.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment: Landowners in the watershed are installing land treatment measures to protect the land from sheet and gully erosion. The project provides for a sound and effective land treatment program to be accelerated on the remaining farms needing treatment during the 4-year project installation period. Major practices planned to accomplish this are: Terraces, contour farming, grassed waterways, conservation tillage, and grade stabilization structures.

Technical assistance will be provided to landowners and farm operators for installation of land treatment measures. During the installation period it is estimated that an additional 630 acres of cropland, 250 acres of pastureland, and 94 acres of forest land will be adequately protected.

Terraces

Level terraces are earth embankments constructed across the slope with the channel and ridgetop built level. They are spaced to reduce erosion by shortening the length of slope available for runoff water. Runoff from a 10-year frequency storm is stored above these terraces. They are used on soils that allow infiltration of the stored water without damage. An estimated 3 miles will be installed.

Contour Farming

Contour farming is a method of farming which entails soil preparation, planting, cultivating, and harvesting along guidelines that are level or nearly level. Contour farming reduces soil erosion by slowing the speed of runoff waters. Downstream peak flows are reduced and more water is infiltrated into the soil. Contour farming will be established on an estimated 1,800 acres during the project installation period.

Grassed Waterways

Grassed waterways are shaped and vegetated drainageways established for the safe conveyance of runoff water.

Conservation Tillage

Conservation tillage is the practice of planting crops with a minimum disturbance of previous crop residue and limiting the number of cultural operations which incorporate residue into the soil. The layer of crop residue dissipates energy from raindrops before they strike the soil surface, thus reducing erosion and permitting more water to infiltrate into the soil. Residues also disrupt ground level wind currents thereby reducing wind erosion and moisture loss. An estimated 100 acres will be installed during the installation period.

Other measures such as wildlife plantings for food and cover are an integral part of conservation planning. Three acres of food and cover plantings or habitat improvements will be installed on farms in the watershed.

Structural Measures: Structural Measures consist of nine grade stabilization structures. These structures inundate unstable gully heads and lower runoff waters from the upstream pool levels to the stable gully bottom through pipe spillways. They are planned to supplement land treatment measures by stabilizing upstream gullies and reducing downstream peak flows and sediment deposition.

All will be reservoir type structures constructed with earth available at the site. The foundations may extend into glacial till in the lower elevations of the watershed but may be entirely in loess soils at higher elevations. The principal spillways will be placed on yielding foundations of compacted fill. The earth fills will be constructed with 3 to 1 sideslopes and will be protected from wave action by level berms.

The principal spillways will be fabricated from corrugated metal pipe of 18-, 21-, or 24-inch diameter. The pipe will have an estimated life of 35 years and will be replaced as needed. Each principal spillway will have hood inlet and either a slotted flume or propped outlet. The outlets will be fabricated from corrugated metal pipe of the same diameter as the spillway.

The reservoirs formed by the structures will provide sediment storage and grade stabilization pools to reduce gully erosion. These pools will range in size from 2.9 acres to 15.2 acres.

During and after periods of rainfall or snowmelt runoff, the pools will rise to higher elevations. All the structures will have storage and principal spillway capacity to pass the runoff from a 25-year frequency storm. Runoff from storms of greater magnitude will flow through the vegetated emergency spillways. The maximum retarding pools will range in size from 5.3 to 30.3 acres.

This type of structure is illustrated in sketch SS-13 with a propped outlet and in figure 2 with a slotted flume outlet.

The grade stabilization pools will provide storage for a minimum of 50 years sediment accumulation. Six of the structures will have pool elevations governed by stabilization needs and provide more storage than is needed for sediment. The pools will be available as aquatic habitat for an estimated 40 years at 3 sites and ranging to 80 years and longer at the other 6 sites.

Runoff from 29 percent of the watershed area will be controlled by the structural measures.

All land which will be occupied by the structural measures will remain in private ownership. Required land rights will be secured by the sponsoring local organizations in the form of easements.

The present use of the land required for structural measures is presented in the following table.

LAND USE SUMMARY

Project Land Use	Present Land Use in Acres				
	Cropland	Pasture	Forest	Other	Total
Permanent or Sediment Pools	10.8	31.9	6.1	-	48.8
Retarding Pools	22.6	21.8	1.9	-	46.3
Dams & Spillways	12.8	11.2	2.7	-	26.7
Total	46.2	64.9	10.7	-	121.8

Construction operations will be in compliance with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement as stated under Project Formulation.

The structures will be designed to minimize potential vector problems. Drains will be installed to eliminate seepy or marshy areas below the dams and surface drainage will be provided for all exposed borrow areas to aid in mosquito control.

All shrubs, trees and stumps will be cleared and grubbed from the area to be occupied by and within 50 feet of the earthfill and spillways. The borrow areas and other construction areas will also be cleared and grubbed.

Cleared materials will be placed in neat, dense piles to provide cover for wildlife. Piles will be located above the emergency spillway crest elevation in locations agreeable to the affected landowner. The pile locations will be planned for maximum use by wildlife and to blend with the landscape.

Grasses and legumes will be established on and around the earthfills and earth spillways, and other areas disturbed by construction activities. Vegetative cover will control erosion and sediment production from these areas. It will also provide wildlife food and cover and esthetic values. Earth fills and spillway areas will be fenced as needed to protect them from overgrazing by livestock.

A reconnaissance study and report by the Iowa Conservation Commission recommends a minimum of 1½ acres be developed to mitigate the loss of habitat at structure L-2. Two acres will be available in the vicinity of L-2 and will be fenced and planted to wildlife food and cover plants.

If artifacts or other items of unique historic or archeological significance are discovered during construction of the project, the National Park Service will be notified through the State Archeologist and the State Historical Preservation Officer.

EXPLANATION OF INSTALLATION COSTS

The project installation costs, as used in this work plan, include all costs to P.L. 566 and other funds, in cash or its equivalent, for installing all works of improvement for the project purposes of watershed protection and flood prevention.

The cost of installing land treatment measures includes all costs for applying those measures and for technical assistance for their planning, layout and installation. The costs also include costs to the farmer, cost sharing from going agricultural programs, and technical assistance from the various Federal-State cooperative forestry programs, and P.L. 46 funds. The estimated cost of installing the land treatment measures is $27,990 (table 1).

The total estimated construction cost of $185,060 (table 1) will be provided from P.L. 566 funds.

Construction costs include all costs for material, equipment and labor necessary for installing the structural measures.

Construction cost includes a contingency cost added to the engineers' cost estimate to provide for unforseeable cost increases during construction. Based upon experience to date in similar watershed work, the contingency cost was estimated to be 12 percent of the engineers' estimate.

The construction costs of mitigation measures to replace cover for wildlife have been included in the construction cost of structure L-2.

Engineering services includes the direct cost of engineers and other technicians for surveys, investigations, design, and preparation of plans and specifications of structural measures. Engineering services costs for the structural measures are estimated to be $36,970 (table 1). P.L. 566 funds will bear the entire amount of these costs.

Land rights costs include all costs and expenditures made in acquiring land or easements, or the value of such lands, if donated. These values are estimated by the sponsors and are in concurrence with the Service. They are estimated to have a value of $19,850 and will be provided from local funds. No relocation or alterations of roads, bridges or pipelines are needed.

The project administration costs are P.L. 566 and other administrative costs associated with the installation of structural measures. They include the cost of contract administration, review of engineering plans prepared by others, government representatives, construction surveys, and necessary inspection services during construction to insure that structural measures are installed in accordance with the plans and specifications. These costs are estimated to be $29,580. They are assigned $27,730 to P.L. 566 funds and $1,850 to local funds (table 1).

At the present time there is no need for relocation payments. If they are needed at a later date they will be cost shared as shown in paragraph 2 of the work plan agreement.

The estimated schedule of Federal and non-Federal obligations by fiscal years, for land treatment and structural measures follows.

Fiscal Year	Structural Measures		Land Treatment		Total
	Federal	Local	Federal	Local	
1	-	-	-	$ 7,000	$ 7,000
2	-	-	-	8,000	8,000
3	$ 20,000	$10,000	-	9,000	39,000
4	229,760	11,700	-	3,990	245,450
Total	$249,760	$21,700	-	$27,990	$299,450

EFFECTS OF WORKS OF IMPROVEMENT

Conservation Land Treatment: Planned land treatment measures will increase the area adequately protected from erosion to 66% compared with 55% without the project. This is an increase of 974 acres.

Land treatment measures will reduce sheet and rill erosion as shown in the following table.

Land Use	Average Annual Gross Sheet and Rill Erosion Tons/Acre/Year	
	Without Project	With Project
Cropland	3.5	2.7
Pasture	2.1	1.0
Forest	1.0	1.0

Crop production can be expected to increase on the acres which will be treated. Sheet erosion causes a loss of plant nutrients and pesticides since many of these chemicals become attached to soil particles. Yields will be higher for a given level of chemical treatment when sheet erosion is reduced.

Terraces will permit a more intensive use of the cropland. More corn and soybeans will be grown instead of small grains, grasses, and legumes. Farm operating costs will be reduced when small fields dissected by gullies are joined by grassed waterway construction.

Sediment produced by sheet and rill erosion which enters the East Nishnabotna River will decrease by 5400 tons per year after installing the land treatment measures.

The grassed backslopes of terraces will occupy about 3 acres which will be converted from cropland to grass. These grass strips will provide nesting areas and travel lanes for terrestrial wildlife.

As grassed waterways are constructed in the gullied areas the existing forms of wildlife will be disrupted. However, waterway areas approximately equal in size will be re-established in grass and legumes.

The elimination of many of the deep gullies will reduce injury and death loss for livestock. The physical risk to farmers in operating machinery along the gullies will also be eliminated.

Structural Measures: The structures will prevent gully erosion damage to 640 acres during the 50-year evaluation period. If the gullies are not stabilized, 270 acres will be voided and 370 acres depreciated from their present use. This is equivalent to losing 1 average size farm and decreasing income on 1.4 average size farms. The average annual land damage will be reduced 95 percent. Gully erosion damage to nine boundary fences and three farm crossings will be reduced 95 percent. Thirty farmers will benefit from reduced gully erosion.

Flooding on 40 acres of bottom land will be reduced from the present frequency of 1.3 years to 6 years. The total flood plain is covered whenever flooding occurs; however, the depth and duration of flooding is less for the frequent floods. With the project installed the depth of flooding will be reduced for all floods. The flood plain is presently used for corn and soybean production and this use is expected to continue. Floodwater damage to crops will be reduced 96 percent. Two farm families will be benefited by the reduction of these damages. Reduction of the flood flows will reduce highway replacement and maintenance costs by an estimated $2,290 annually. Two bridges may be replaced with culverts. Road maintenance costs will be reduced at three locations.

The structures will accumulate sediment at the rate of 7.6 acre-feet per year. Storing this sediment will decrease the amount available for deposition in stream channels on the East Nishnabotna River flood plain. Channel capacity for floodflows and channel depth for drainage will be maintained for longer periods and cleanouts will be reduced. These damages on 430 acres on 5 farms will be reduced 90 percent.

Sediment entering the East Nishnabotna River from the watershed follows.

Source	Sediment		
	Present Tons/year	With Project Tons/year	Reduction Tons/year
Sheet & rill erosion	14,600	9,200	5,400
Gully erosion	27,700	2,200	25,500
Total	42,300	11,400	30,900

Sediment entering the East Nishnabotna River from the watershed will be reduced from 42,300 tons to 11,400 tons annually.

Sediment produced from sheet erosion contains pesticides and plant nutrients. By reducing the amount of this sediment leaving the watershed a corresponding reduction will be made in the amount of pesticides and plant nutrients leaving the area.

Studies[1/] of agricultural runoff water show that pesticides reach Iowa streams both as soluble material and through adsorption on soil particles which make up much of the sediment in Iowa rivers. In this study, approximately 50% of the pesticide load was carried by the sediment which gradually settles to the bottom and remains there for extended periods.

Agricultural chemicals are used on cropland fields that are 75% of Pierce Creek No. 2 Watershed. Amount of agricultural chemicals leaving crop fields are variable and data are not available on levels entering the East Nishnabotna River. However, 10,900 tons of sediment will be prevented from entering the East Nishnabotna River annually by the planned project. This will result in reduced levels of agricultural chemicals leaving the watershed.

The structures will initially provide 48.8 acres of water. These pools in a watershed area with eight small farm ponds will increase the aquatic habitat significantly. The addition of water areas and their fringes will create additional ecological niches in the watershed ecosystem. The diversity supplied from the creation of these niches will have a stabilizing effect by making the food web more complex and less sensitive to perturbation. The landowner or farm operator on whose land the pool is located may stock it with fish. All sites were evaluated to determine their potential for public recreation. Public recreation as a purpose was abandoned when it was determined that none of the sites could be developed for any significant amount of recreation. Public access will not be provided at any of the sites. Outdoor recreation in the form of hunting and fishing in the watershed area has traditionally been supplied by private landowners. Since the limited recreational opportunity associated with the project is not enough to attract a new or different public, there is no reason to believe that it will not be made available as other private lands have been in the past. These pools will be in existence for about 40 years at 3 of the sites and for 80 years or longer at the other 6.

Installation of the structures will result in the loss of 9.4% of forest land, 0.4% of cropland, 3.3% of pastureland. Crop production on 10.8 acres, pasture production on 31.9 acres, forest production on 6.1 acres, and terrestrial wildlife habitat on 48.8 acres will be lost to the pools. The dams and spillways will cause the loss of crop production on 12.8 acres, pasture production on 11.2 acres, and forest production on 2.7 acres and will temporarily interrupt wildlife

1/ Chlorinated Hydrocarbon Pesticides in Iowa Rivers. Pesticides Monitoring Journal, 4 (4): 216-219, 1971.

Dieldrin Levels in Fish from Iowa Streams. Pesticides Monitoring Journal 5: 12-16, 1971.

Pesticides and Heavy Metals in the Aquatic Environment. Health Laboratory Science, Vol. 9, No. 2, April 1972.

use of 26.7 acres. After these areas are revegetated they will be available as grassland habitat for wildlife use.

Floodwater in the retarding pools of the structures can result in reduction of crop yields on 22.6 acres, interruption of pasture use on 21.8 acres and interruption of wildlife use of 46.3 acres. About 4 miles of ephemeral stream channel will be flooded by the pools of the structures and the wetland habitat in these channels modified.

A water supply will be created that will be available for livestock consumption and firefighting.

Four of the structures will be located close to farmsteads and the noise of construction operations will be bothersome. The noise at the other structures should not bother people because of the distance of their homes from the sites.

Dust from construction operations will get into the atmosphere; however all possible precautions will be taken to minimize the amount of airborne soil particles.

PROJECT BENEFITS

The annual evaluated gully erosion damage to agricultural land of $15,330 will be reduced to $730 for a benefit of $14,600. Other agricultural damages of $1,560 will be reduced to $70 for a benefit of $1,490.

The average annual evaluated floodwater damages to cropland of $920 will be reduced to $40 for a benefit of $880 (table 5). Non-agricultural damages of $2,400 will be reduced to $110 for a benefit of $2,290 (table 5).

The reduction of damages from sediment will be reduced from $1,500 to $150 or a benefit of $1,350 (table 5).

Indirect damages of $2,200 which accompany the direct damages will be reduced to $110 giving a benefit of $2,090 (table 5).

The average annual value of local secondary benefits are $90 (table 6). Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

COMPARISON OF BENEFITS AND COSTS

The annual installation costs of the structural measures are $16,320. The annual operation and maintenance costs are $1,210.

The average annual primary flood prevention benefits from the structural measures, excluding local secondary benefits, are $22,540; this compared

with the average annual cost of $17,530 gives a benefit-cost ratio of 1.3 to 1.0.

The average annual primary and local secondary flood prevention benefits from the structural measures in the project of $22,630 compared with the average annual cost of $17,530 gives a benefit-cost ratio of 1.3 to 1.0 (table 6).

PROJECT INSTALLATION

The project measures will be installed during a 4-year project installation period. The local sponsoring organizations and the Service will coordinate the installation of the structural measures in the project with the planning and application of land treatment measures on the individual farms.

Land treatment measures will be installed by individual farmers or small groups of farmers working together through the Districts with technical assistance provided by the Service.

The forest land treatment measures will be installed by the landowners with technical assistance provided by the Iowa Conservation Commission, Forestry Section, in cooperation with the U.S. Forest Service.

Engineering services for all structural measures will be performed or contracted for by the Service. All structural measures will be installed by contract. The Page County District will contract for and install all structural measures.

Project administration will be provided by the Service and by the local sponsoring organizations, each as assigned for the satisfactory completion of the work.

The sponsoring local organizations will acquire or provide assurance that landowners or water users have acquired such water rights as the State law may require for installation and operation of the works of improvement.

Each District will acquire land rights for structural measures located therein. The Page County District will obtain the land rights for the 2 acres of mitigation measures.

Should the Districts not be able to acquire such land rights for the structural measures, the counties have the power of eminent domain and will use this authority if necessary to obtain the land rights for the structural measures included in this project.

After the required land rights have been acquired and certification made for the adequacy of land treatments, a Project Agreement for construction of all structural measures in an evaluation unit will be executed. This will be followed by an invitation to bid. Each agreement

will be between the Service and the Page County Soil Conservation District and will set forth responsibilities of each party.

FINANCING PROJECT INSTALLATION

Federal assistance for installing the works of improvement on the non-Federal land, as described in this work plan, will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666, as amended).

Individual landowners will assume the cost of installing land treatment measures with such cost-sharing assistance as may be available from going agricultural cost-sharing programs.

Land treatment measures to be installed on agricultural land, is estimated to cost $19,590. This amount, will be provided by the landowners with cost-sharing assistance from going programs (table 1).

The total cost of installing forest land treatment measures is estimated at $8,400. Technical assistance to woodland owners for the installation of these measures will cost $3,400. This amount will be shared by the State and Federal governments through the Cooperative Forest Management Program. The $5,000 installation costs will be paid by the landowners.

The Service will assume the entire cost for construction, engineering services and mitigation for all structural measures included in this project.

Land rights for the structural measures including the mitigation measures, are expected to be donated by the landowner or otherwise obtained by the County and District in which the structure is located.

Funds for local costs are made available to local sponsors through a ¼-mill levy on all agricultural lands in the two counties involved in the project.

The work plan does not constitute a financial document to serve as a basis for the obligation of Federal funds. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the individual landowners and/or operators as prescribed in the conservation plans developed between the farmers and the Districts. Technical assistance for all land treatment measures except forestry measures will be made through the Districts by the Service. The Iowa Conservation Commission, Forestry Section, cooperating with the U.S. Forest Service through the Cooperative

Forest Management Program, will provide technical assistance for the forestry measures.

The structural measures included in this project are planned and designed to serve project objectives. The total benefits to be derived from all measures cannot be realized unless the measures are operated and maintained in such a manner that they will serve the full purpose for which they were installed. The program for operation and maintenance consists of:

1. An agreed-to plan which will provide adequate and sound arrangements for proper operation, timely inspection, and prompt and appropriate performance of needed maintenance which will be in accordance with specifications of the Iowa Operation and Maintenance Handbook; financing the costs of operation and maintenance; and the maintaining of records reflecting the actions required and taken.

2. Carrying out of the provisions of the agreed-to plan in a manner consistent with the spirit, intent, and purpose of the plan and project.

3. All duties performed for operation and maintenance will be carried out in accordance to specifications as set forth in the Iowa Operation and Maintenance Handbook.

In accordance with Iowa Law, the 2 counties involved in this project will levy taxes as needed in each county on agricultural lands, not to exceed ¼-mill per year. These funds will be used for the operation and maintenance of the works of improvement. The revenue from this taxation is considered to be adequate to meet these estimated costs.

All structures including the mitigation measures located in Page County will be maintained by that District. Structure L-3 is located in Montgomery County and will be maintained by that District.

The establishment period for vegetative work is when adequate vegetative cover is obtained, two growing seasons after initial installation of vegetative work, or the establishment period for the associated structural measure. The State Conservationist may approve cost sharing for additional work to obtain adequate vegetative cover during this period.

Operation and Maintenance Agreements setting forth all details in connection with responsibilities for operation and maintenance of structural measures will be executed prior to the signing of project agreements for construction.

Inspection of the structural measures will be made annually by the local sponsoring organizations and the Service for 3 years after the

structure is completed. After the third year, the annual inspections will be made by the local sponsors. Additional inspections will be carried out following a severe storm or any other unusual condition that might adversely affect the structural measures. These inspections will determine the need for and amount of the following types of maintenance to be done by the sponsors:

1. Replacing soil removed by erosion and rodents on earth fills and emergency spillways.

2. Re-establishing vegetative cover on earth fills, emergency spillways, and borrow areas.

3. Removing debris accumulations in sediment and retarding pools.

4. Keeping trash racks in proper working order.

5. Replacing or repairing damaged sections of the principal spillways.

6. Stabilizing the outlets of the principal spillways.

7. Removing undesirable vegetation from earth fills and emergency spillways.

8. Mowing the grass-legume vegetation in the inlet channel and 1 mower width across the exit channel below the control section of the emergency spillway. This vegetation will be mowed so its height will be 6 to 8 inches or less.

The Service will participate in operation and maintenance only to the extent of (1) furnishing technical assistance to aid in inspections and (2) furnishing technical design information necessary for operation and maintenance. When operation and maintenance is not being properly carried out, as found from inspections by the Service, the matter will be brought to the attention of the local sponsoring organizations.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Pierce Creek No. 2 Watershed, Iowa

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/					Total
			P.L. 566 Funds		Other			
			Non-Fed. Land		Non-Fed. Land			
			SCS 3/	Total	SCS 3/	F.S. 3/	Total	
LAND TREATMENT								
Land Areas 2/								
Cropland	Ac.	630			12,990		12,990	12,990
Pastureland	Ac.	250			3,750		3,750	3,750
Forest Land	Ac.	94				5,000	5,000	5,000
Technical Assistance					2,850	3,400	6,250	6,250
TOTAL LAND TREATMENT					19,590	8,400	27,990	27,990
STRUCTURAL MEASURES								
Construction								
Grade Stab. Structures	No.	9	185,060	185,060				185,060
Subtotal - Construction			185,060	185,060				185,060
Engineering Services			36,970	36,970				36,970
Project Administration								
Construction Inspection			22,190	22,190	190		190	22,380
Other			5,540	5,540	1,660		1,660	7,200
Subtotal - Administration			27,730	27,730	1,850		1,850	29,580
Other Costs								
Land Rights					19,850		19,850	19,850
TOTAL STRUCTURAL MEASURES			249,760	249,760	21,700		21,700	271,460
TOTAL PROJECT			249,760	249,760	41,290	8,400	49,690	299,450

Footnotes 1-3, see Page 30

FOOTNOTES - TABLE 1
Pierce Creek No. 2 Watershed, Iowa

1/ Price base - 1973

2/ Includes areas estimated to be treated during the project installation period.

3/ Federal agency responsible for assisting in installation of works of improvement.

Date: April 1974

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Pierce Creek No. 2 Watershed, Iowa

Item	Unit	Applied to Date: Amount	Applied to Date: Value 1/ (Dollars)
Soil Conservation Service			
Land Treatment Measures			
Contour Farming	Ac.	1,753	3,510
Minimum Tillage	Ac.	100	500
Grassed Waterways	Ac.	38	15,470
Terraces, Level	L. Ft.	274,530	41,180
Terraces, Gradient	L. Ft.	20,200	3,030
Terraces, Seeded Backslope	L. Ft.	6,940	1,390
Diversions	L. Ft.	7,405	1,260
Grade Stabilization Structures	No.	11	33,000
Pasture & Hayland Planting	Ac.	42	1,680
Tile Drains	L. Ft.	12,364	5,190
Pasture & Hayland Management	Ac.	424	2,120
Wildlife upland habitat mgt.	Ac.	15	1,200
Conservation Plans	No.	27	--
Cooperators	No.	30	--
Forest Service			
Fire Control	Ac.	58	60
TOTAL			109,590

1/ Price Base - 1973

Date: April 1974

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Pierce Creek No. 2 Watershed, Iowa

(Dollars) 1/

Item	Installation Cost P.L. 566 Funds			Installation Cost-Other Funds		Total Installation Cost
	Construction	Engineering	Total	Land Rights	Total Other	
H-1	16,630	3,330	19,960	1,350	1,350	21,310
J-1	17,110	3,420	20,530	1,450	1,450	21,980
J-2	15,960	3,190	19,150	1,400	1,400	20,550
J-4	20,720	4,140	24,860	1,400	1,400	26,260
J-5	20,670	4,130	24,800	1,900	1,900	26,700
J-6	14,120	2,820	16,940	650	650	17,590
K-1	17,020	3,400	20,420	1,600	1,600	22,020
L-2	32,420	6,460	38,880	6,800	6,800	45,680
*L-3	30,410	6,080	36,490	3,300	3,300	39,790
Subtotal	185,060	36,970	222,030	19,850	19,850	241,880
Project Administration	xx	xx	27,730	xx	1,850	29,580
GRAND TOTAL	185,060	36,970	249,760	19,850	21,700	271,460

1/ Price Base - 1973

* Includes construction and land rights costs for mitigation

Date: April 1974

TABLE 3 - STRUCTURAL DATA

Structures With Planned Storage Capacity

Pierce Creek No. 2 Watershed, Iowa

Item	Unit	STRUCTURE NUMBER									
		H-1 1/	J-1 1/	J-2 1/	J-4 1/	J-5 1/	J-6 1/	K-1 1/	L-2	L-3	Total
Class of Structure		a	a	a	a	a	a	a	a	a	
Drainage Area	Sq.Mi.	0.25	0.25	0.56	0.61	0.26	0.27	0.21	1.21	0.68	
Uncontrolled	Sq.Mi.	0.25	0.25	0.31	0.34	0.26	0.27	0.21	1.21	0.68	
Controlled	Sq.Mi.	-	-	0.25	0.27	-	-	-	-		
Curve No. (1-day) (AMC II)		72	73	73	72	72	72	75	74	75	
Tc	Hrs.	0.33	0.30	0.39	0.47	0.31	0.34	0.22	0.62	0.60	
Elevation Top of Dam	Ft.	1077.0	1090.0	1046.0	1054.5	1056.0	1106.0	1061.0	1068.5	1092.5	
Elevation Crest Emergency Spillway	Ft.	1075.0	1088.0	1044.0	1052.5	1054.0	1104.0	1059.0	1066.5	1090.5	
Elevation Crest High Stage Inlet	Ft.	1070.0	1082.0	1037.0	1046.0	1050.0	1097.0	1054.0	1059.0	1083.5	
Maximum Height of Dam	Ft.	37	26	30	36	26	26	28	37	39	
Volume of Fill	Cu.Yd.	19,000	19,200	14,200	21,000	21,900	10,500	16,940	36,400	39,000	198,140
Total Capacity	Ac.Ft.	46.5	47.4	64.6	86.3	57.0	42.0	41.0	275.0	155.0	814.8
Sediment Submerged 1st 50 years	Ac.Ft.	25.0	21.0	26.0	37.5	32.6	13.8	18.2	101.0	58.0	333.1
Sediment Aerated	Ac.Ft.	3.6	1.9	2.2	2.6	6.1	2.5	2.2	17.0	8.2	46.3
Retarding	Ac.Ft.	17.9	24.5	36.4	46.2	18.3	25.7	20.6	157.0	88.8	435.4
Surface Area											
Sediment pool	Ac.	2.9	3.0	3.6	4.9	5.1	2.9	3.0	15.2	8.2	48.8
Retarding pool	Ac.	5.6	5.9	7.8	10.0	7.3	5.4	6.0	30.3	19.5	97.8
Principal Spillway											
Rainfall Volume (areal) (1 day)	In.	-	5.62	5.62	5.62	-	5.62	5.62	5.62	5.62	
Rainfall Volume (areal) (10 day)	In.	-	9.4	9.4	9.4	-	9.4	9.4	9.4	9.4	
Runoff Volume (10 day)	In.	-	3.42	3.58	3.40	-	3.29	3.88	3.75	3.9	
Capacity of High Stage (Max.)	cfs	18	19	25	19	19	19	33	44	21	
Frequency operation - Emer. Spillway	% Chance	4	4	4	4	4	4	4	4	4	
Size of Conduit	Dia. In.	18	18	21	18	18	18	18	24	18	
Emergency Spillway - Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	
Rainfall Volume - (ESH) (areal)	In.	-	5.32	5.32	5.32	-	5.32	5.32	5.32	5.32	
Runoff Volume (ESH)	In.	-	2.09	2.24	2.15	-	2.03	2.41	2.62	2.44	
Bottom Width	Ft.	18	16	30	26	18	16	16	60	32	
Velocity of Flow (V_e)	Ft/Sec.	-	0	1.5	0	-	0	0	0	0	
Slope of Exit Channel	Ft/Ft.	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
Maximum water surface elevation	Ft.	1076.0	1087.6	1044.1	1052.2	1055.0	1103.7	1058.2	1066.4	1090.4	
Freeboard											
Rainfall Volume (FH) (areal)	In.	-	7.8	7.8	7.8	-	7.8	7.8	7.8	7.8	
Runoff Volume (FH)	In.	-	4.20	4.33	4.22	-	4.11	4.57	4.74	4.59	
Maximum water surface elevation	Ft.	1077.0	1089.6	1045.8	1054.5	1056.0	1105.6	1060.2	1068.5	1092.3	
Capacity Equivalents											
Sediment Volume 2/	In.	2.07	1.72	1.71	2.19	2.81	1.15	1.81	1.83	1.82	
Retarding Volume	In.	1.29	1.84	2.21	2.52	1.33	1.81	1.83	2.42	2.45	

1/ Structure does not fall within the limiting criteria of SCS Engineering Memorandum 27, designed for SCS-Iowa criteria.

2/ The principal spillway crest elevation was established for grade stabilization or sediment storage, which ever was greater; therefore, the storage at the crest elevation may be greater than that required for sediment.

Date: April 1974

TABLE 4 - ANNUAL COSTS

Pierce Creek No. 2 Watershed, Iowa

(Dollars) 1/

Structural Measures	Amortization of Installation Cost	Operation and Maintenance	Total
H-1	1,270	120	1,390
J-1, J-2	2,560	240	2,800
J-4, J-5, J-6	4,250	370	4,620
K-1	1,320	120	1,440
L-2, L-3	5,140	360	5,500
Project Administration	1,780	XX	1,780
TOTAL	16,320	1,210	17,530

1/ Price Base - Installation Costs are based on 1973 price level and are amortized at 5 5/8 percent over 50 years.
Operation and Maintenance costs are based on current prices.

Date: April 1974

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Pierce Creek No. 2 Watershed, Iowa

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Gully Erosion 2/			
Land	15,330	730	14,600
Other Agricultural Damages	1,560	70	1,490
Subtotal	16,890	800	16,090
Floodwater			
Crop and Pasture	920	40	880
Non-Agricultural Damages	2,400	110	2,290
Subtotal	3,320	150	3,170
Sediment			
Clean-out	1,500	150	1,350
Indirect	2,200	110	2,090
TOTAL	23,910	1,210	22,700

1/ Price Base - Agricultural prices - November 1973.

2/ Damages and benefits are included for only the principal gully erosion areas which are affected by the project improvements.

Date: April 1974

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Pierce Creek No. 2 Watershed, Iowa

(Dollars) 1/

Evaluation Unit	Structural Measures	AVERAGE ANNUAL BENEFITS			Average Annual Cost	Benefit Cost Ratio
		Damage Reduction	Secondary Benefits	Total		
1	H-1	1,400	-	1,400	1,390	1.0 to 1.0
2	J-1, J-2	3,630	90	3,720	2,800	1.3 to 1.0
3	J-4, J-5, J-6	5,940	-	5,940	4,620	1.3 to 1.0
4	K-1	2,550	-	2,550	1,440	1.8 to 1.0
5	L-2, L-3	9,020	-	9,020	5,500	1.6 to 1.0
Project Admin.	XX	XX		XX	1,780	XX
TOTAL		22,540	90	22,630	17,530	1.3 to 1.0

1/ Price Base - Agricultural prices, November 1973, for benefits, costs from Table 4.

In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $160.00 annually.

Date: April 1974

INVESTIGATIONS AND ANALYSES

A study was made of present land use in the watershed. This study included the present classifications of land use such as cropland, pasture, forest land and other. The land treatment measures that have been installed were itemized for each land capability class. This study was developed from information of record and from district conservationists.

The amount of soil lost from sheet erosion under present conditions and with the planned land treatment measures installed were studied and computed for use in formulating an adequate land treatment program.

A conservation needs study was then made above each structure to show all of the land treatment measures that would be required to reduce soil loss from sheet erosion to tolerable amounts.

In consideration of the above information, Service technicians with assistance of District Commissioners, developed land use changes and land treatment measures that would be installed during the project installation period. Information was tabulated for areas above planned structural measures. These tabulations consisted of capability class, land use, mechanical practices, and crop rotations. The land treatment measures to be applied during the project installation period represents the expected accomplishments of the sponsors and farmers.

Erosion Investigation

A field reconnaissance was made to study the type and extent of erosion problems that are causing damage to land and improvements in the watershed.

Accelerated sheet erosion is a problem on land in need of treatment. Gully erosion is causing voiding of crop and pasture lands and depreciation of adjacent and intervening areas. Damage to roads, fences, and farm crossings is occurring in the watershed.

Studies were made of the gully systems above all of the planned structures in the watershed to determine the rate of land voiding and land depreciation.

A set of 1938 and 1966 (8-inch to the mile scale) aerial photos of the areas was studied and the extent of the rate of gully erosion during that time was plotted on overlays and measured. With the aid of a set of 1966 (4-inch to the mile scale) photos the extent of the present gully erosion was field checked and recorded. These data were tabulated and computed to determine the present extent of voiding. The annual rate of voiding was obtained by dividing the difference between the voided areas, as determined above, by the number of intervening years.

Field observation and interviews of farmers and other people were conducted according to Technical Release No. 32. Rates of gully growth were adjusted to provide an estimate of a future rate. Consideration was given to the amounts of land treatment that have been installed and planned. Other factors that affect future gully growth are: Topography, soil type, rainfall, depth of gully, and subsurface drainage.

The upper limits of the 50-year gully growth in the natural waterway was considered as the voided area. When future gully advance was limited by culverts with permanent floor elevations (not bridges), no area was considered as void or depreciated above this point in relation to controls below. If there was an individual gully system developing above the road culvert, the evaluation for voiding and depreciation was made separately from that below the road.

Based on the expected future extension of a gully system, delineations were made on overlays to show areas that would depreciate to another use in a 50-year evaluation period. The annual rate of land depreciation was calculated from this information.

Rates of land depreciation were based upon the following assumptions:
(1) Cropland isolated by gully growth would depreciate to a lesser use if it were not practical or economical to farm or graze.
(2) Areas along gullies extending from the voided area to the lowest terrace were considered as each situation dictated.

The volume of gully erosion without and with project was calculated for drainage area of each structure. Field measurements were made to determine the width, depth and bottom width of gullies (cross-section areas). These were multiplied by the rate of gully advance and divided by age of gully to arrive at rate of gross erosion under present conditions. It was assumed that since most of the waterflow would be contained within the gully, the eroded material would be delivered as sediment downstream. The volume of sediment from gully erosion with project installed, was calculated by considering the effectiveness of the project.

The Universal Soil Loss Equation for Predicting Soil Loss in Iowa was used to compute soil losses by sheet erosion on the basis of cover, slope length, percent of slope, soil characteristics, rainfall, and management practices. This data was obtained from the local district conservationist, area staff, soil scientists, State technical staff, conservation plans, field inspection, and a study of soil surveys. The volume of sheet erosion under existing conditions and with project was developed for each structure.

An estimate of the sheet erosion delivery ratio to a site was based upon general information secured in past studies. It was estimated

that a range from 60 to 80 percent of gross sheet erosion is transported downstream. The losses that occur in transit are deposited on alluvial slopes, in valleys, road ditches, channels, fence lines, and in or adjacent to waterways.

Estimates of sediment conveyed to a structure were recorded on Form SCS-309. This form was used in providing sediment storage needs in the design of each structure.

A field reconnaissance was made to observe the geological, physiographical, and other features of the watershed which might influence the selection of a site and the design of a structure. Construction experience in other watersheds with similar characteristics was useful as a guide in appraising the geological feasibility of sites selected.

All planned structures were observed by the geologist and planning engineer. Based upon these observations and previous experience of similar sites, it appears that foundation conditions are adequate and satisfactory borrow materials are available. Further investigations as required will be made at all sites prior to construction. The extent and complexity of these investigations will vary from site to site. Sufficient funds have been included in the estimate of engineering design for this purpose.

Biological Investigation

A tri-agency watershed biology review was held with representatives from the U.S. Fish and Wildlife Service, Iowa Conservation Commission, and the Soil Conservation Service. The review consisted of office discussion and field review of the project. Recommendations concerning fish and wildlife resources were made by the Fish and Wildlife Service and Iowa Conservation Commission to the Soil Conservation Service. Written acknowledgement of the recommendations was made accepting or stating the reason for rejecting recommendations.

Hydraulic and Hydrologic Investigations

Several alternative plans of structural works of improvement were investigated for the watershed.

Weather Bureau Technical Paper No. 40 was used to determine the amount and frequency of rainfall to be expected in this area for storms of different durations. Rainfall data were used for estimating amounts of runoff because no stream gages are located in the watershed.

The hydrologic runoff curve numbers were computed for the present land use and treatment and for the anticipated future land use and treatment. The runoff curve number is an index of the runoff

producing potential of an area as related to the local soil types, cover conditions, and land treatment. These runoff curve numbers were used to estimate the runoff volumes to be considered in the design of the detention structures and in the evaluation of the frequency of flooding.

The evaluation of the frequency of flooding was made using Technical Release No. 20 - Project Formulation Program-Hydrology. The extent of the area flooded was obtained from aerial photographs and field checked with the landowners affected.

The capacity of the channel below structure J-2 was developed from nine cross sections using Mannings equation.

Runoff amounts for 7 rainfall events, ranging in frequency from 0.5 years to 100 years, were routed to determine the peak flow discharges.

Economic Investigations

The evaluation of gully erosion damage to land was based on the annual land losses from voiding and depreciation. These annual rates, for voiding and depreciation, were multiplied by the per acre damageable values to find total damages that occur at each site. These per acre values represent losses that will occur in future years, since the damage cannot be recovered.

The land use and crop rotations considered for these evaluations are within the criteria and standards determined through soil surveys and land use capability classifications. The level of yields used were those obtained by farmers following a moderately high level fertility and management program and an intensity of farming operations consistent with the most intensive practical cropping pattern applicable within the area. Where associated soil and water conservation measures are necessary to make possible the above level of intensity of farming, the average annual value of the cost of the associated measures were deducted from the total average annual damage.

The gross income from the land affected was determined on a per acre basis as the monetary values of all the products grown on the area, e.g., field crops and pasture, times their respective normalized price per unit. These values, when combined and weighted, gave the composite per acre gross income figure for the land that would be void and depreciated without the planned project.

The gully damage evaluation takes account of: (1) Loss of income to farm operators during a 10-year adjustment period, (2) market value of the loss to landowners of a land resource, (3) value of the loss to local public interests of real estate tax base income, and (4) value of the loss to public interests not reflected in the market values of a land resource.

Damages without the project, with land treatment measures, and with the structural measures installed were computed.

All of the above procedures, and the methods involved, are set forth in the SCS Economics Guide, Chapter 5, "Appraisal of Sediment and Erosion Damage". Crop yield data for soils of these areas were based upon interviews, SCS technicians and material published by ERS for Missouri River Basin for projected yields for years 1980, 2000 and 2020, the experience of farmers practicing conservation farming, and SCS technicians.

Floodwater damages were obtained by interviews. Assistance was received from the hydrologist in estimating acres that would be affected. It was estimated that 40 acres would be affected.

Estimated crop yields used for floodwater damage evaluation are as follows:

	Without Project	With Project
Corn	110 bu.	140 bu.
Soybeans	25 bu.	40 bu.

The entire area affected is used as cropland.

Other agricultural damages such as farm fences and field crossings were obtained from field observation. Boundary fences were the only fences evaluated. Farm crossings were evaluated from the standpoint of reduction in maintenance costs.

Information on roads and bridges was obtained by field observation. Reduction in costs for maintenance, repair and replacement costs for maintenance, repair and replacement were considered as a benefit to the project.

A review of cleanout costs for sediment in channel below structure K-1 were used in computing benefits from sediment. This review indicated that $1,500 was spent annually for cleanout. After structure K-1 is installed this cost would be reduced to $150. This gives a benefit of $1,350 from the reduction in damages from sediment.

Indirect damages were estimated to be 10% of all damages except road damages which were computed at 15%. These damages include additional expenses, loss of time and other inconveniences occurring in the watershed due to damages from erosion and flooding.

Secondary benefits were evaluated only for floodwater. These benefits were estimated to be 10% of the floodwater benefits to crop and pasture.

The estimated costs of land rights for structural measures are as follows:

Cropland or Pasture	$300/ac.
Other	$ 50/ac.

These estimates were agreed to by the sponsoring local organizations and the Service.

Installation costs of structural measures were amortized at 5½% interest rate for a period of 50 years. Operation and maintenance costs were computed at 0.35% of the estimated construction cost of the structural measures.

Engineering Design and Cost Estimates

The design of structural measures is based on applicable SCS criteria and design procedures. These include SCS national and State Engineering handbooks, Engineering Memorandum SCS-27 and other sources of recognized engineering design material.

A stereoscopic study of aerial photographs was made to select potential sites for floodwater, sediment, and gully stabilization structures. Field examination of each potential site was then made by the planning engineer and area engineer to develop definite structure proposals. Topographic maps were developed by photogrammetric method from medium level flights for all of the structures.

Other information used in selection of sites included the size of drainage area, location of overfalls, property lines, suitability of site, field access and road problems, wildlife and forest land involved, and other information gathered by members of the planning party in regard to damages that included flood and sediment damages.

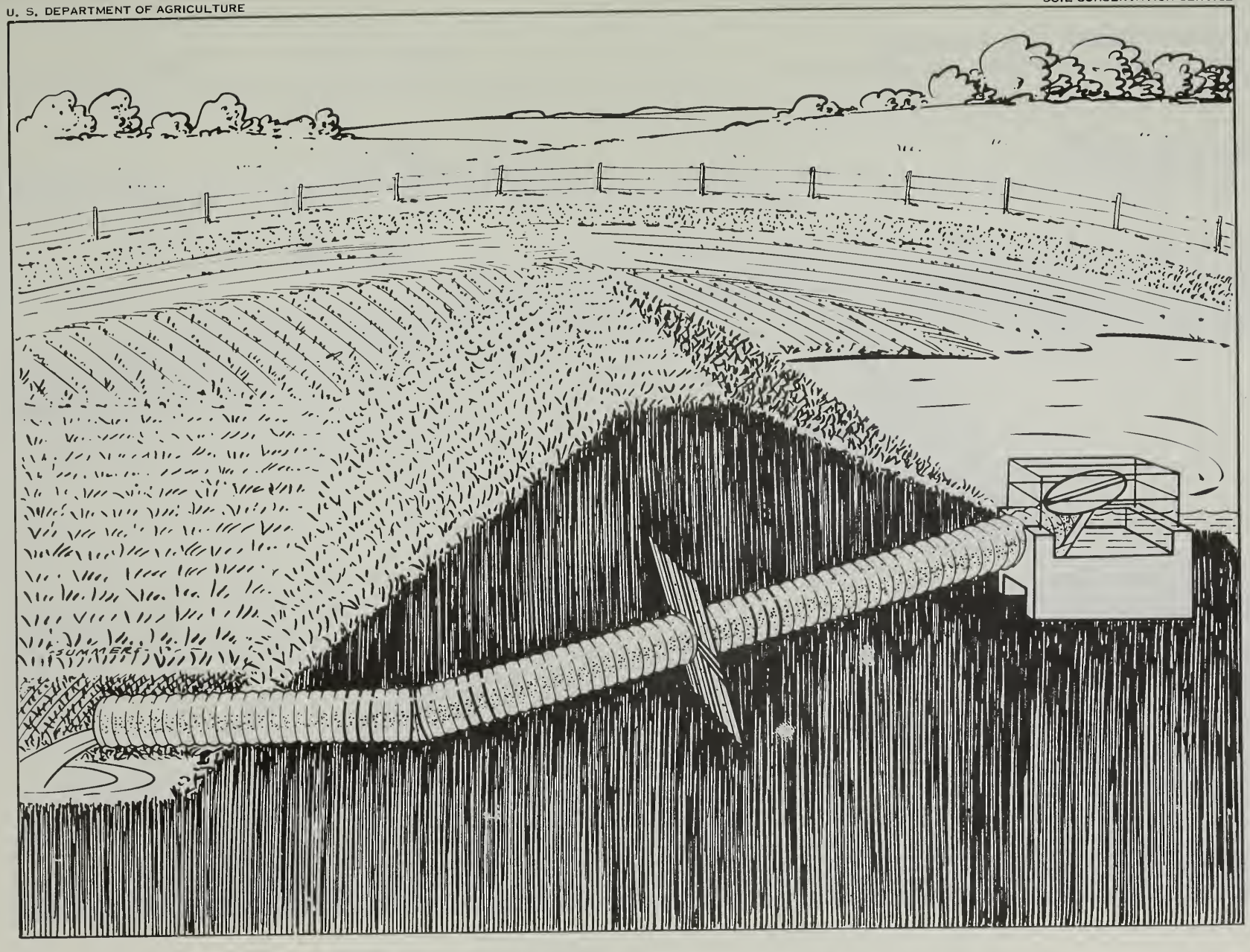
The state conservation engineer, area engineer, district conservationist, and all the local sponsors were consulted when necessary to develop agreement and understanding regarding the structure or combination of measures that would best meet the needs.

Review of structures in Pierce Creek No. 1 Watershed adjacent and similar to this watershed showed that soils in the reservoir areas should be sufficiently impervious to maintain the grade stabilization pools. No problems have been encountered in maintaining pool levels in Pierce Creek No. 1 Watershed with similar size drainage areas and constructed in and of the same type of soils. Geologic conditions are similar for the watersheds.

Based upon experiences of costs for structures at similar sites, the head control required and the effectiveness of the various types of structures in stabilizing the gullies and reducing downstream peak

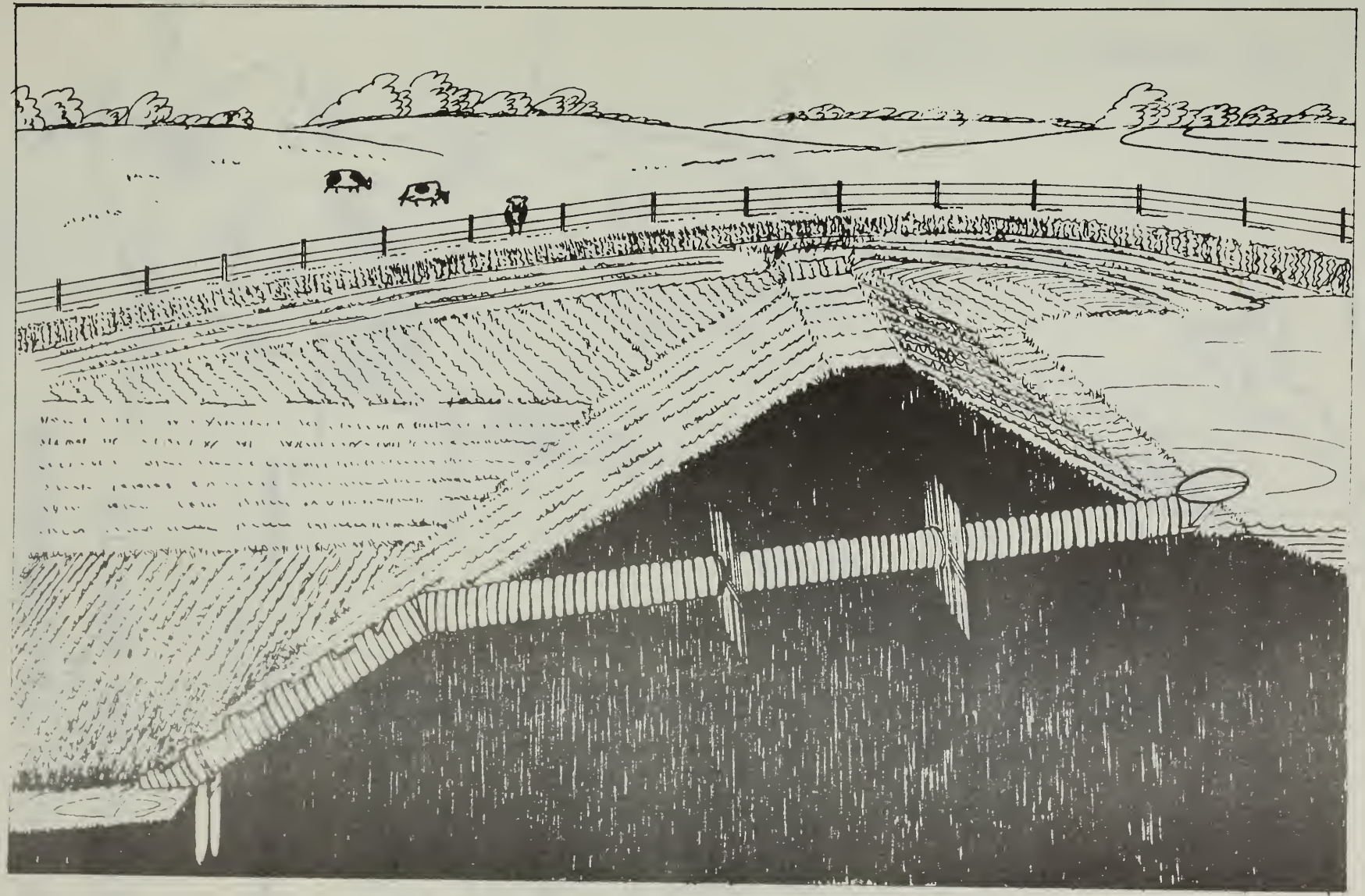
flows and sediment, the drop inlet detention structure was determined to be the most feasible for all the sites. Additional grade stabilization was needed, but they were found to not be economically feasible.

Corrugated metal pipe was used as the principal spillways in all the structures.



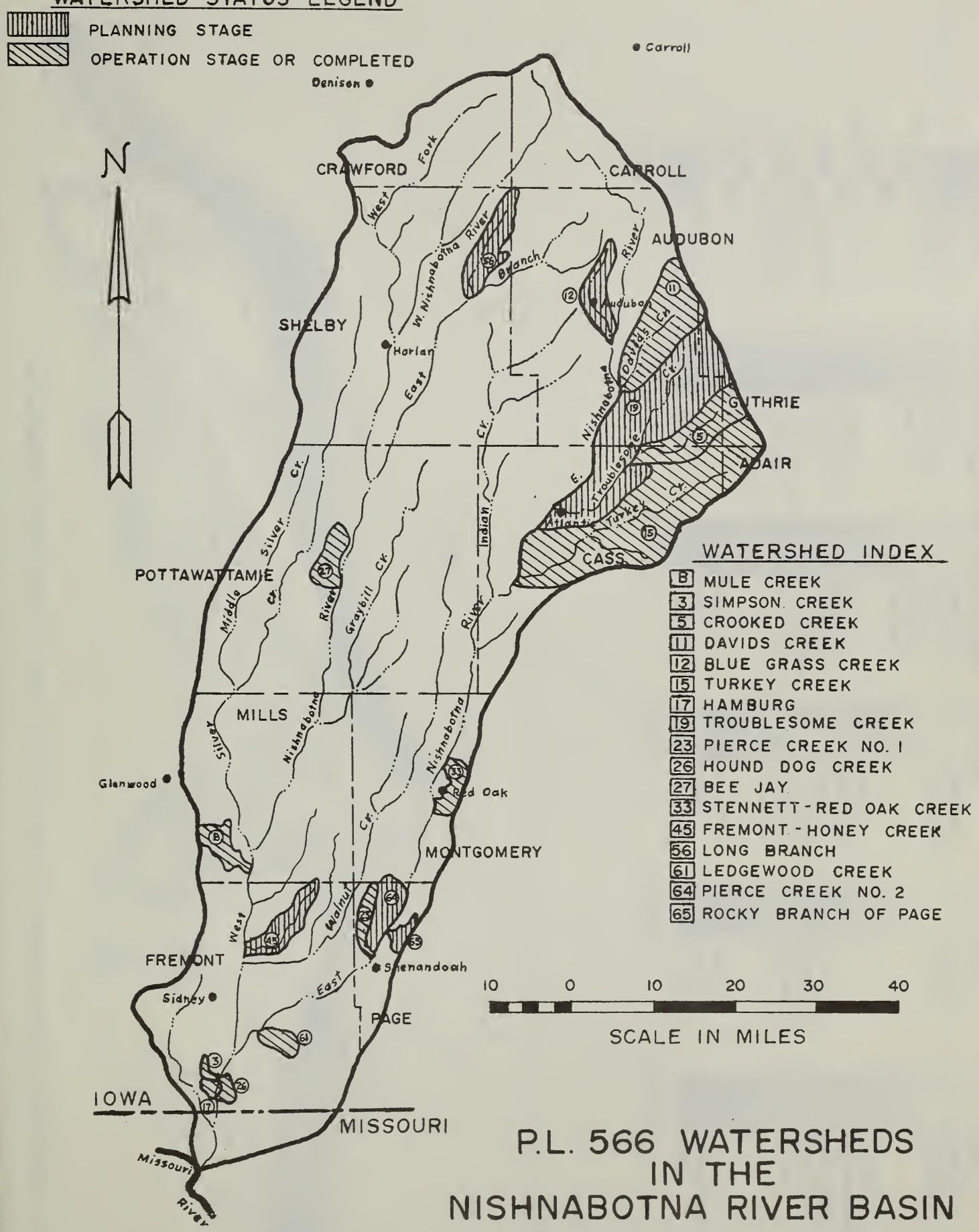
Metal pipe with hooded inlet and trash guard.

USDA-SCS-LINCOLN NEBR 1965



Metal pipe with hooded inlet and slotted flume outlet

Figure 2

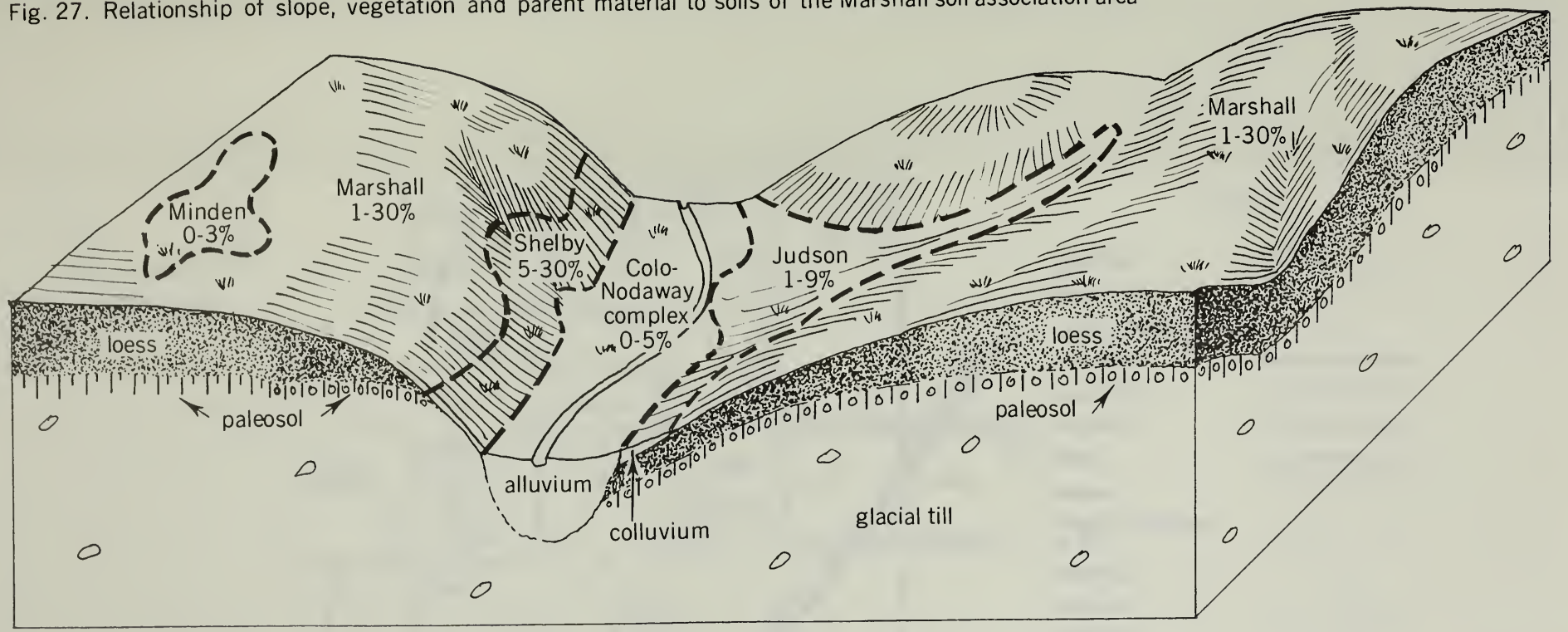


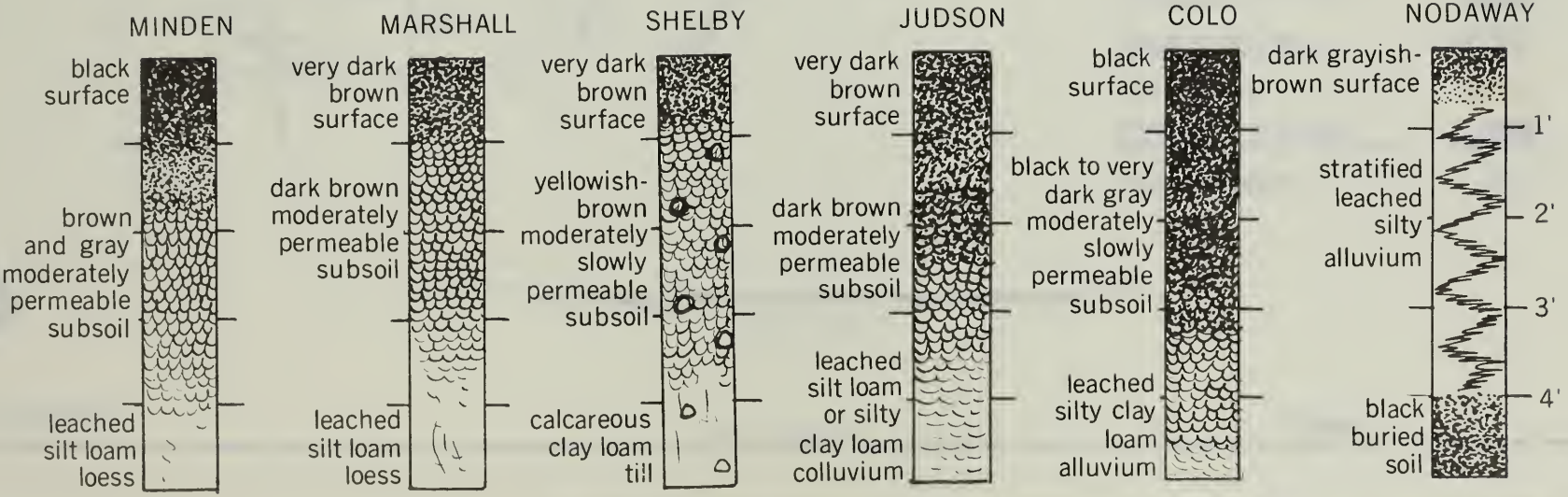
P.L. 566 WATERSHEDS IN THE NISHNABOTNA RIVER BASIN

FIGURE 3

10-4-73

Fig. 27. Relationship of slope, vegetation and parent material to soils of the Marshall soil association area.



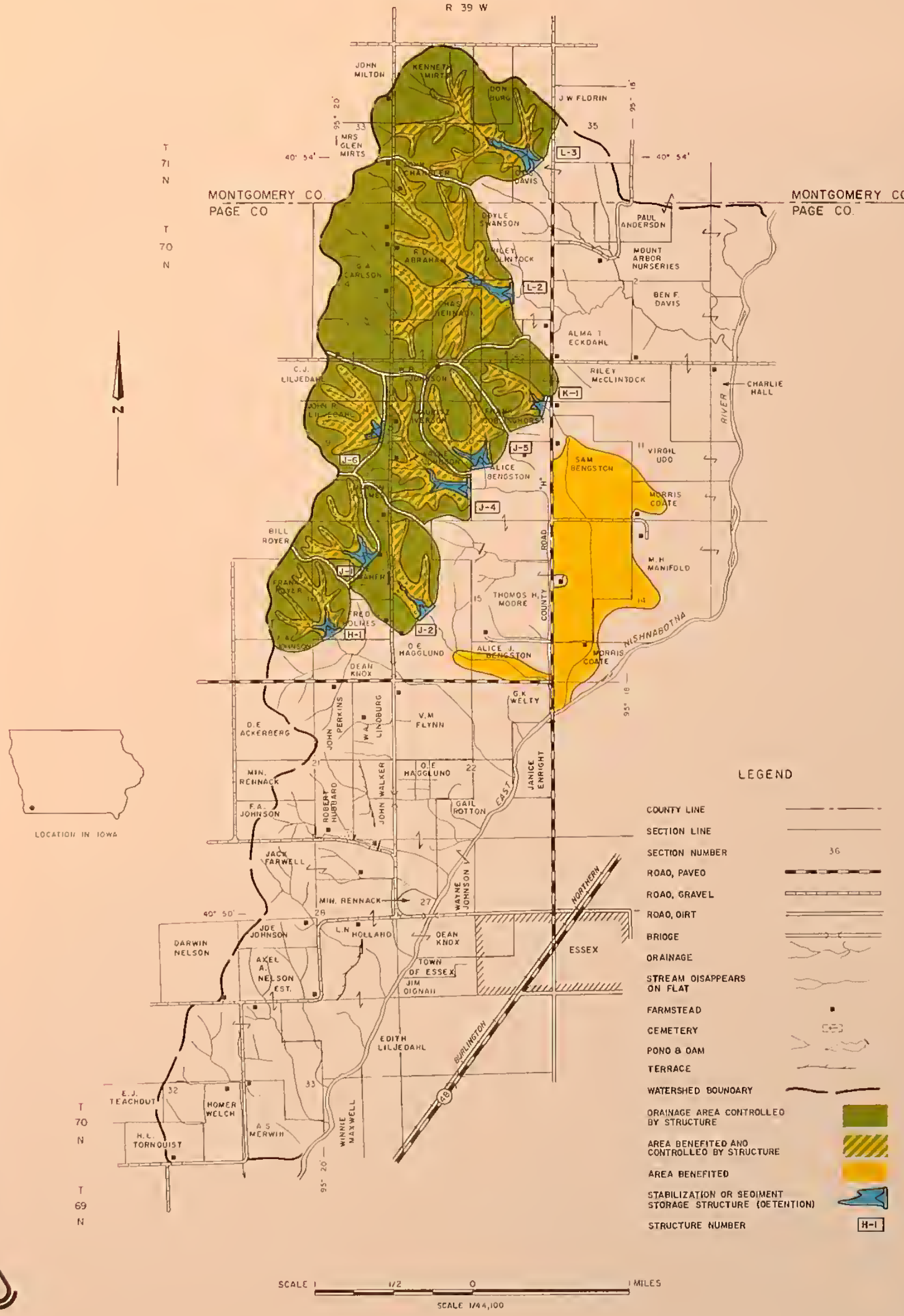


U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

PROJECT MAP
PIERCE CREEK #2 WATERSHED
MONTGOMERY AND PAGE COUNTIES
IOWA

TOTAL DRAINAGE AREA 8,360 ACRES



LEGEND

- COUNTY LINE
- SECTION LINE
- SECTION NUMBER 36
- ROAD, PAVED
- ROAD, GRAVEL
- ROAD, DIRT
- BRIDGE
- DRAINAGE
- STREAM DISAPPEARS ON FLAT
- FARMSTEAD
- CEMETERY
- POND & DAM
- TERRACE
- WATERSHED BOUNDARY
- DRAINAGE AREA CONTROLLED BY STRUCTURE
- AREA BENEFITED AND CONTROLLED BY STRUCTURE
- AREA BENEFITED
- STABILIZATION OR SEDIMENT STORAGE STRUCTURE (DETENTION)
- STRUCTURE NUMBER H-1

SCALE 1 0 1/2 1 MILES

SCALE 1/44,100

SOURCE: SCS BASE MAP 5,P-25,330 AND DATA FURNISHED BY FIELD TECHNICIANS

(POLYCONIC PROJECTION)

FIGURE 1

REV 4-23-74
5,P-31,251